

## Claims

We claim:

- 1           1. A method for performing optical signal and beam distribution in a heterodyne  
2 interferometer, the method comprising:  
3           providing a planar lightwave circuit comprising a plurality of waveguide optical  
4 transmission elements and an input coupler and an output coupler arranged along the optical  
5 transmission elements;  
6           matching optical pathlengths of the transmission elements between the input coupler and  
7 the output coupler to compensate for thermal effects; and  
8           determining reference and measurement optical phases employing the input coupler and  
9 the output coupler.  
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1           5. The method according to claim 1, wherein the output coupler comprises a waveguide  
2           directional coupler with a 50:50 splitting ratio.

1           6. The method according to claim 1, wherein the output directional couplers are operable  
2           to provide a differential output appropriate for balanced detection.

1           7. The method according to claim 1, wherein the output couplers comprise a 2x2  
2           multimode interference device operable to provide a differential output appropriate for balanced  
3           detection.

1           8. The method according to claim 1, wherein the output coupler comprises a 2x1  
2           combiner operable to provide a single ended output.

1           9. The method according to claim 1, further comprising:  
2           utilizing at least one of the input coupler and the output coupler to split off a reference  
3           phase signal; and  
4           selecting a coupling ratio for at least one of the input coupler and the output coupler to  
5           optimize a detected heterodyne output signal when unequal losses are encountered in either  
6           measurement optical paths or reference optical paths.

1           10. The method according to claim 1, further comprising:  
2           fabricating the planar lightwave circuit in silica on silicon.



1 11. The method according to claim 10, further comprising:  
2 fabricating the planar lightwave circuit in silica on silicon utilizing planar lightwave  
3 fabrication processes.

1 12. The method according to claim 1, further comprising:  
2 fabricating the planar lightwave circuit in silica on quartz.

1 13. The method according to claim 1, further comprising:  
2 fabricating the planar lightwave circuit from at least one of a polymer, a III-V  
3 semiconductor, silicon, and lithium niobate.

1 14. The method according to claim 1, further comprising:  
2 achieving dimensional control of waveguide and device critical dimensions of the planar  
3 lightwave circuit utilizing microelectronic photolithographic techniques to provide the planar  
4 lightwave circuit.

1 15. The method according to claim 1, further comprising:  
2 achieving dimensional control of matched planar lightwave circuit waveguide lengths  
3 utilizing microelectronic photolithographic techniques.

1 16. The method according to claim 1, further comprising:  
2 designing crossings of the transmission elements for application specific required  
3 minimal crosstalk.



1 17. The method according to claim 1, further comprising:  
2 fabricating selected mode polarization strippers at an input port and an output port of the  
3 planar lightwave circuit.

1 18. The method according to claim 17, further comprising:  
2 positioning a metal layer above or below the planar lightwave circuit; and  
3 inducing optical evanescent H-field currents in the metal to selectively strip a TM  
4 polarization mode off at the input and output ports.

1 19. A device operable to distribute optical signals and beams in a heterodyne  
2 interferometer, the device comprising:  
3 a planar lightwave circuit comprising a plurality of waveguide optical transmission  
4 elements; and  
5 an input coupler and an output coupler arranged along the optical transmission elements  
6 and operable to determine reference and measurement optical phases, wherein optical  
7 pathlengths of the optical transmission elements between the input coupler and the output  
8 coupler are matched to compensate for thermal effects.

1 20. The device according to claim 19, wherein the couplers comprise optical waveguide  
2 directional couplers.

1 21. The device according to claim 19, wherein the couplers comprise multimode

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2 interference devices.

1 22. The device according to claim 19, wherein the couplers comprise waveguide Y-  
2 branch couplers.

1 23. The device according to claim 19, wherein the output coupler comprises a waveguide  
2 directional coupler having a 50:50 splitting ratio.

1 24. The device according to claim 23, wherein the output coupler is operable to provide a  
2 differential output appropriate for balanced detection.

1 25. The device according to claim 20, wherein the output coupler is operable to provide a  
2 differential output appropriate for balanced detection.

1 26. The device according to claim 19, wherein the output coupler comprises a 2x2 multi-  
2 mode interference device operable to provide a differential output for balanced detection.

1 27. The device according to claim 19, wherein the output coupler comprises a 2x1  
2 combiner operable to provide a single ended output.

1 29. The device according to claim 19, wherein at least one of the input coupler and the  
2 output coupler is operable to split off a reference phase signal.

1           30. The device according to claim 19, wherein at least one of the input coupler has a  
2 coupling ratio operable to optimize a detected heterodyne output signal when encountering  
3 unequal losses in measuring optical paths or reference optical paths.

1           31. The device according to claim 19, wherein the optical transmission elements are  
2 embedded in a silica layer.

1           32. The device according to claim 19, wherein the substrate is silicon.

1           33. The device according to claim 19, wherein the substrate is quartz.

1           34. The device according to claim 19, wherein the planar lightwave circuit comprises at  
2 least one of a polymer, a III-V semiconductor, silicon and lithium niobate.

1           35. The device according to claim 19, wherein the planar lightwave circuit further  
2 comprises:  
3 crossings of the waveguide optical transmission elements, the waveguide crossings being  
4 operable for application specific required minimal crosstalk.

5  
6           36. The device according to claim 19, further comprising:  
7 selected mode polarization strippers arranged at an input port and an output port of the  
8 planar lightwave circuit.

1 37. The device according to claim 36, wherein the TM polarization mode is selectively  
2 stripped off at the input and output ports by the use of optical evanescent H-field induced  
3 currents in an appropriately positioned metal above or below the optical waveguide.

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